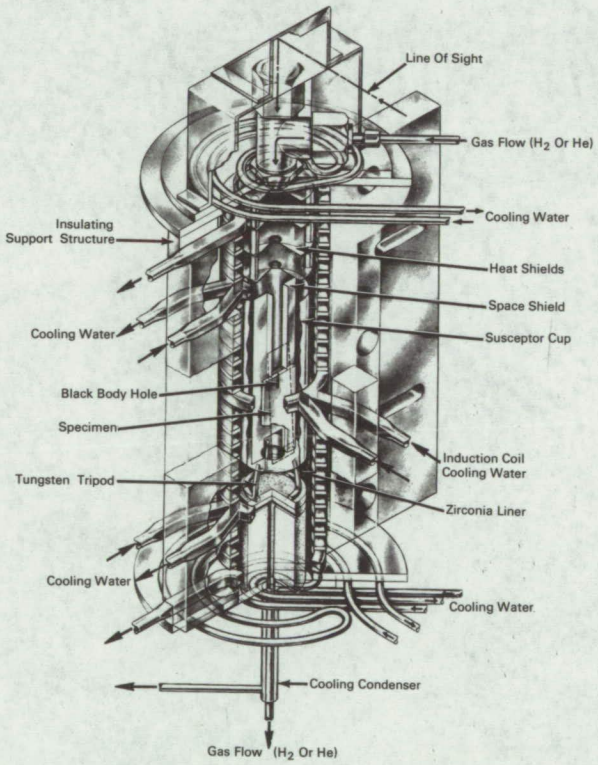
February 1966 Brief 66-10055

NASA TECH BRIEF

Hydrogen-Atmosphere Induction Furnace Has Increased Temperature Range



The problem: To construct a hydrogen (or inert-gas, e.g., helium) atmosphere induction furnace that will operate at temperatures up to 5,350° F. The furnace must heat up and cool down rapidly during an effective life of several hundred cycles in normal use at operating temperatures below 5,000° F.

The solution: An induction furnace of improved design. The furnace is powered by a 75 kw, 10 kcps generator.

How it's done: The principal design details of the furnace are shown in the illustration. The turns of square copper tubing, which serve as the induction coil, are spaced 1/16-inch apart by brass pins brazed to the outside surfaces of the tubing. These pins are inserted in properly spaced holes in the insulating (asbestos composition) support structure. The space between adjacent turns is filled with a castable zirconia (ZrO_2). The exterior surface of each turn facing the

(continued overleaf)

support structure is insulated with a thin layer of castable zirconia and a 0.75-inch layer of alumina (Al_2O_3), and the entire outside surface of the cylinder formed by the coil assembly is sealed with fiber glass impregnated with an epoxy resin. The exterior surfaces of the turns facing the center of the furnace are sprayed with zirconia to a depth of 30 mils, using rod-flame spray apparatus. A prism and viewing port for line-of-sight optical pyrometry are provided at the top of the furnace.

Notes:

1. This induction furnace will heat up from room temperature to 4,750°F in 30 seconds and cool down to room temperature in 2 minutes.
2. The furnace life will exceed 100 hours at an operating temperature of approximately 5,000°F, using a purified-hydrogen flow rate of 10 to 40 cubic feet per hour.
3. By replacing the inside zirconia liner with a high-temperature radiation shield or refractory thoria, operating temperatures of approximately 6,000°F can be achieved.
4. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio, 44135
   Reference: B66-10055

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated by NASA.

Source: Robert M. Caves and
Charles H. Gresslin
(Lewis-153)